The *Standard Horizon HX300* programming interface

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Abstract

This document describes the electrical characteristics of the programming interface utilized by the *Standard Horizon HX300* floating handheld VHF radio. Two examples of programming interfaces are provided.

The *CE134* programming software will still be required for programming the radio.

The Standard Horizon HX300.

Disclaimer

The sole purpose of this document is to provide owners of the *Standard Horizon HX300* handheld VHF radio with information on how to make the most out of their units.

While the *Standard Horizon HX300* radio may come with relevant end-user documentation included, details regarding the programming interface are indeed sadly lacking.

The author does not represent any manufacturer of software products or hardware units mentioned in this document. Likewise, the author does not have any commercial interests in any of the companies or products mentioned in this document. The author happens to own and use a *Standard Horizon HX300*, though.

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The author assumes no responsibility for your use of information contained in this document. The information in this document has been used to successfully program a *HX300E* unit.

NOTE: Consult your national legislation regarding radio frequency usage before programming the *Standard Horizon HX300*. National legislation may limit your rights to add user channels to the radio. Never transmit on frequencies on which you are not licensed to operate.

Contents

1 Introduction

1.1 The *Standard Horizon HX300* floating handheld VHF radio

The *Standard Horizon HX300* floating handheld VHF radio can be programmed with extra VHF "user channels" as required. When adding "user channels" to the radio, please take great care not to transmit on frequencies on which you are not licensed to operate. The official frequency ranges for the *HX300* are listed as follows [9]:

Transmit (TX): 156.025 to 157.425 MHz

Receive (RX): 156.050 to 163.275 MHz

Actual use has proven that the unit is capable of receiving and transmitting on a wider frequency range, including frequencies in the 145 MHz amateur radio band. The actual unit on which this test has been performed, is labeled *HX300E*, serial number JB3B060xxx. Section 3.1 mentions possible bandwidth limitations in radios destined for the US market.

NOTE: When *reading* the memory contents from the *HX300* and other *Standard Horizon* radios, channels/frequencies outside the above specified frequency ranges have the kHz-portion zeroed out. E.g. user-programmed channel *L1* (Nordic pleasure craft channel 1 at 155.500 MHz) will download as 155.000 MHz.

It has not been determined whether this behavior is caused by radio firmware/EEPROM limitations or the PC-side *CExxx* PPS software.

1.2 The original *HX300* programming interface

The programming interface of the *Standard Horizon HX300* utilizes a mini-USB connector which is also used for charging the radio. It should be noted that the communication between the PC and the *HX300* does not actually take place using standard USB communication. A direct connection between the PC and the radio, using an ordinary USB/mini-USB cable will only provide charging of the *HX300.* Programming the radio will not be possible using an ordinary USB/mini-USB cable.

The original programming software for the *HX300,* named *CE134,* includes schematic which details the required parts, as prescribed by *Standard Horizon*:

CT-172 cloning cable, which hooks up to the mini-USB-like interface of the *HX300*.

USB-62B cable, which (1) adds a serial port via USB to the computer and (2) provides voltage level conversion to TTL levels (5V).

The *USB-62B* cable is easily available as it is commonly used also with *Yaesu* amateur radio transceivers [5] — hardly surprising, as the *Standard Horizon* brand is controlled by *Yaesu Musen Co., Ltd.*, well-known manufacturer of amateur, marine and airband transceivers.

It should be noted that other interfacing options also exist, as detailed in section 2 of this document.

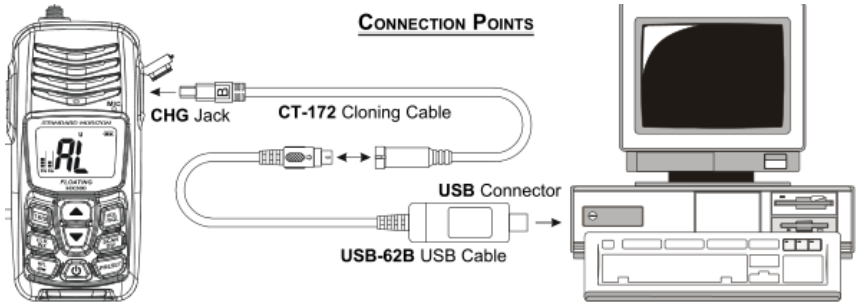

Figure 1: Original programming setup for the HX300 as described in the CE134 documentation. For reasons unknown, the CT-172 cable assembly seems somewhat hard to get hold of. No worries, there are several other options available.

2 The *HX300* USB interface

Communication with the *HX300* for programming purposes takes place using serial communication at 19,200 and 57,600 baud, utilizing TTL voltage levels at 5V.

The *USB-62B* USB cable assembly readily provides TTL voltage levels. A *USB-62B*-like cable assembly is available from *RT Systems, Inc.*, listed as the *CT-62* [5]. The original *Standard Horizon CT-172* cable assembly seems to be a bit harder to get hold of. Luckily, the original *CT-172* is not really required for programming the *HX300* radio.

Other interfacing options include the *FTDI Basic Breakout* from *SparkFun Electronics, Inc* [7] and the *FTDI Friend* from *Adafruit Industries, LLC* [1] which will both provide the required TTL voltage levels and a serial port via USB. Similar TTL/serial port via USB breakout units (5V) are also available from *eBay* [3] at very reasonable prices.

Also, owners of the *Standard Horizon CT-99* cable assembly can easily use jumper wires to hook up to the *USB-62B* for programming the *HX300*. Either way, a mini-USB connector is required for connection to the *HX300*.

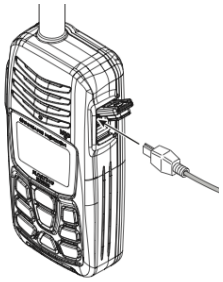

Figure 2: The HX300 mini-USB connection. Illustration from HX300 user's manual [9].

Figure 3: The Standard Horizon CT-99 cable assembly which will attach to the USB-62B.

2.1 A brief examination of the *HX300* mini-USB connector

Standard Horizon opted for a mini-USB connector both for charging and for programming the *HX300* radio. The charging takes place using the *Vcc* and *ground* lines of the mini-USB connector. It is important to emphasize that programming the radio does *not* utilize normal USB data transfers and that *a normal USB/mini-USB cable cannot be used to program the radio*.

The mini-USB connector contains five pins:

Vcc +5V DC. Used only for charging the *HX300*.

Ground Used for charging the *HX300* and as signal ground reference (`GND`).

Data+ `TX` at the radio end (TTL signal levels at 5V).

Data- `RX` at the radio end (TTL signal levels at 5V).

ID Not used with the *HX300*.

The `TX` (″Data+″) and `RX` (″Data-″) lines as well as `GND` are required for programming the *HX300* radio. Note that the ″Data+″ and ″Data-″ notions only apply to the pin names in the mini-USB connector — they are not the actual signal names as used in a ″proper″ USB interface.

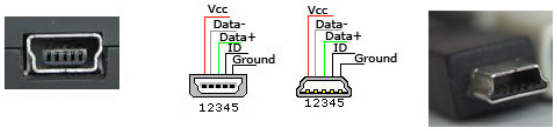

Figure 4: The pinout of the mini-USB connector. Note that wire colors may vary.

A mini-USB cable can probably be scavenged from the parts bin. It will need a slight modification as shown in figure 5.

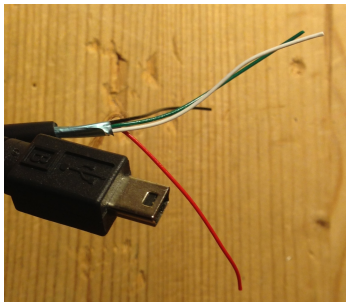

Figure 5: The mini-USB connector about to face its final destiny. Note that wire colors may vary.

From here on, proceed either via *the CT-99 route* (if you already have access to the mentioned cable assemblies) or *the FTDI Friend route* (if you first need to go shopping).

2.2 Option 1: Using the *USB-62B* and the *CT-99* cable assemblies

For those who happen to have the *Standard Horizon CT-99* cable assembly around, the remaining process will be fairly straightforward. The *CT-99* is required for programming a number of fixed-mount *Standard Horizon* radios. It also happens to provide an easy means of hooking up to the *USB-62B* for accessing the `TX DATA`, `RX DATA` and `GND` lines.

The pinout of the USB-62B connector is identified in documentation accompanying interface units for certain *Yaesu* amateur radio products, including the *Yaesu FT-817/D* radio.

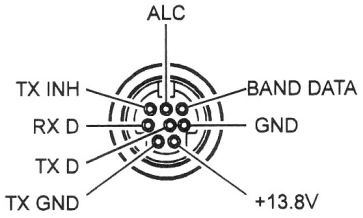

Figure 6: The USB-62B connector (female). The essential pins are labeled TX DATA, RX DATA and GND and reflect the signal names at the radio end of the cable.

Using a multimeter with the *CT-99* cable assembly, the pinout is easily identified. Figure 8 refers — note the notch and the orientation of the connector.

The *CT-99* should be plugged into the *USB-62B* which in turn should be plugged into a PC/USB port. At the *CT-99* end, refer to figure 8 for details on how to route the `TX DATA`, `RX DATA` and `GND` signal wires into the mini-USB connector which goes into the *HX300* radio.

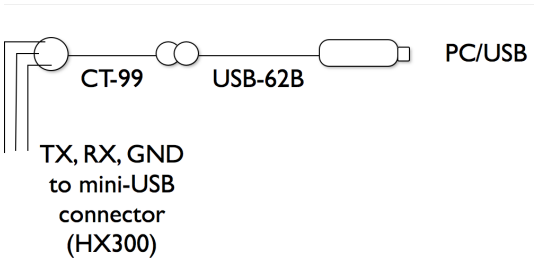

Figure 7: The USB-62B connected to the CT-99, wired to the mini-USB connector which in turn goes into the HX300.

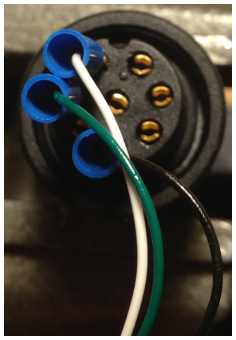

Figure 8: In this particular setup, BLACK=ground, WHITE=RX DATA, GREEN=TX DATA — signal names are valid at the radio end of the cable. The green, white and black wires belong to the mini-USB connector which goes into the HX300. Refer to figures 4 and 5 for a review of the mini-USB pinout.

2.3 Option 2: Connecting to the *FTDI Friend* (and the likes)

The FTDI [4] option is probably the least expensive route provided a *USB-62B* cable assembly (and/or a *CT-99* cable assembly) is not already available.

FTDI interfacing options include the *FTDI Basic Breakout* from *SparkFun Electronics, Inc.* [7] and the *FTDI Friend* from *Adafruit Industries, LLC* [1] which will both provide the required TTL voltage levels and a serial port via USB, including easily accessible *Windows, MacOS* and *Linux* drivers. Similar TTL/serial port over USB breakout units (5V) are also available from *eBay* [3] at very reasonable prices.

It should be noted that several of the FTDI breakouts are capable of operating at both 3.3V and 5V levels. Refer to the device documentation regarding how to configure correct signal levels (5V).

The setup for programming the *HX300* using a FTDI device is simple. The `TX DATA`, `RX DATa` and `GND` lines are required. Wiring details are described in table 1.

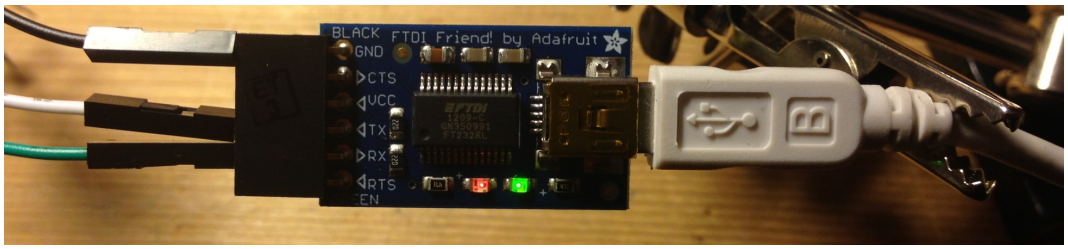

Figure 9: The Adafruit FTDI Friend hooked up to the PC (white mini-USB cable on the right) and to the HX300 (the three wires on the left leading to the mini-USB connector).

FTDI Friend signal name	Wire color	HX300 signal name	USB pin name
RX	Green	TX DATA	Data+
TX	White	RX DATA	Data-
GND	Black	GND	Ground

Table 1: Wiring details. "USB signal name" does not imply actual USB signals, it is only used as a reference to figure 4. NOTE: wire colors may vary.

3 *HX300* programming software

3.1 The *CE134* PPS programming software

The *Standard Horizon* programming software for the *HX300* is called *CE134*. It may or may not be available from various online resources as the software is normally made available to authorized *Standard Horizon* dealers only. There may or may not be different versions of the software for the USA (possibly bandwidth limited) and non-USA (not bandwidth limited) markets.

Several of the *Standard Horizon* radios available on the US market are known to be bandwidth limited. It has not been established whether this also applies to the *HX300*. The *Wide Band Programming Recovery Tool* may be able to allow extended bandwidth operation also on the *HX300*. This utility is available from *The Vertex Radio Group* site [8].

The original *CE134* software will establish a handshake with the *HX300* at 19,200 baud and continue the communication with the radio at 57,600 baud. The protocol seems to be identical to the protocol used with the *HX851* radio, briefly described in [6].

In order to place the *HX300* in programming/cloning mode, first switch the radio off — then connect the USB cable and keep the `PRESET` key pressed in while switching the radio on. The LCD display should indicate "CL" and move on to indicate "CP" once communication has been established with the programming software.

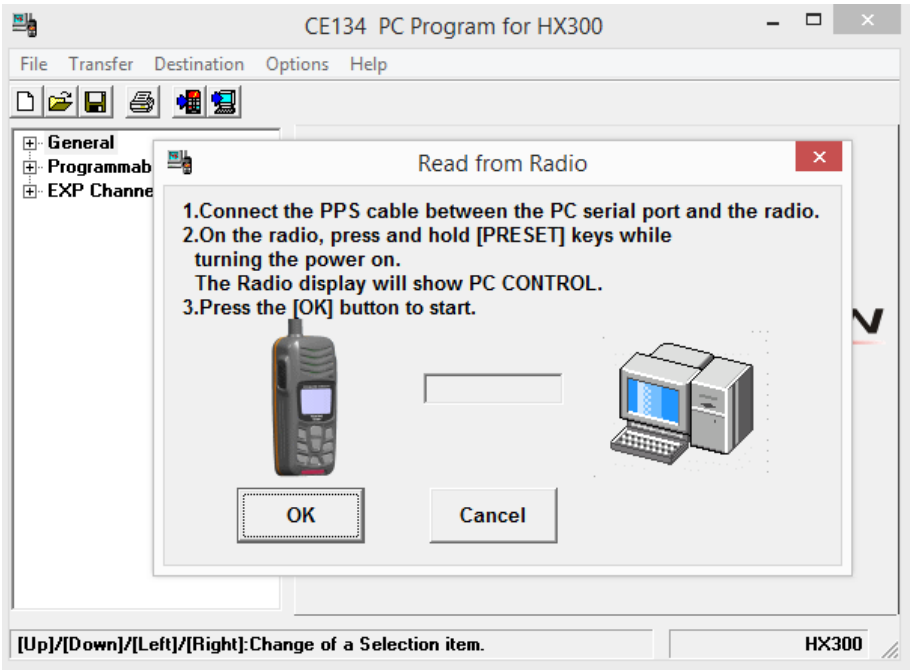

Figure 10: Screenshot from the CE134 PPS software.

3.2 DIY programming software

There is currently no known DIY programming software available for the *HX300*. The *CHIRP* project [2] may or may not support programming the *HX300* in present or future releases.

Readers who have in-depth knowledge of the programming protocol employed by *Standard Horizon* radios, including the *HX300*, are encouraged to forward these details to the author. Section 4.1 contains relevant contact information.

3.3 Dump of communication between the *HX300* and the *CE134* software

This excerpt shows some of the communication taking place between the *HX300* and the *CE134* programming software during a ”read to PC” operation.

The ”handshake sequence” occurs at 19,200 baud when the *CE134* software sends the letter ”P” to the radio. Once the radio responds with a ”P”, the *CE134* software sends the `ACMD:002` command and switches the baud rate to 57,600. At this moment the *HX300* LCD display changes from ”CL” to ”CP”. This is followed by a series of commands from the *CE134* software — reading the memory contents at numerous EEPROM memory addresses.

```
PPP
ACMD:002
\#CMDSY
\#CMDOK
\#CMDSY
\#CMDOK
\#CEPSR         00        74
\#CMDOK
\#CEPSD         00        62
\#CMDOK
\#CEPRD         0080        02        60
\#CMDOK
\#CEPDT         0080        02        012C        1F
\#CMDOK
\#CEPRD         07FE        02        6C
\#CMDOK
\#CEPDT         07FE        02        012C        13
\#CMDOK
\#CEPRD         0000        10        6B
\#CMDOK
\#CEPDT         0000        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        64
\#CMDOK
\#CEPRD         0010        10        6A
\#CMDOK
\#CEPDT         0010        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        65
\#CMDOK
\#CEPRD         0020        10        69
\#CMDOK
\#CEPDT         0020        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        66
\#CMDOK
\#CEPRD         0030        10        68
\#CMDOK
\#CEPDT         0030        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        67
\#CMDOK
\#CEPRD         0040        10        6F
\#CMDOK
\#CEPDT         0040        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        60
\#CMDOK
\#CEPRD         0050        10        6E
\#CMDOK
\#CEPDT         0050        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        61
\#CMDOK
\#CEPRD         0060        10        6D
\#CMDOK
\#CEPDT         0060        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        62
\#CMDOK
\#CEPRD         0070        10        6C
\#CMDOK
\#CEPDT         0070        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        63
\#CMDOK
\#CEPRD         0080        10        63
\#CMDOK
\#CEPDT         0080        10        012C00200001000020100 1FFFF020102       1C
\#CMDOK
\#CEPRD         0090        10        62
\#CMDOK
\#CEPDT         0090        10        0101010102010001000102011 5FFF000       1F
\#CMDOK
\#CEPRD         00A0        10        1A
\#CMDOK
\#CEPDT         00A0        10        FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF        15
\#CMDOK

(etc. etc.)
```

4 Et cetera

4.1 Contact information

Readers who have in-depth knowledge of the programming protocol employed by *Standard Horizon* radios, including the *HX300*, are encouraged to forward these details to the author.

Contact information, web address, et cetera:

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Email → `tmj@bitwrap.no` (no technical questions, please).

Web → `http://www.annoyingdesigns.com/HX300`

Remember → Always have the appropriate amount of fun.

List of abbreviations

COM Communications port.

DC Direct Current.

DIY Do-It-Yourself.

EEPROM Electrically Erasable Programmable Read-Only Memory.

FTDI Future Technology Devices International Ltd. `http://www.ftdichip.com`.

LCD Liquid Crystal Display.

MHz Megahertz.

PC Personal Computer.

PPS Personal Programming System.

RS-232 A standard for serial communication transmission of data.

RX Receive.

TTL Transistor-transistor logic.

TX Transmit.

USB Universal Serial Bus.

V Volt.

VHF Very High Frequency (30 to 300 MHz).

References

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